REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) International Technology Transfer The Rope to Hang the West	5. TYPE OF REPORT & PERIOD COVERED Study Project 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) LTC Neil W. Grotegut	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army War College Carlisle Barracks, PA 17013-5050	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE 28 Mar 89 13. NUMBER OF PAGES 37
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The United States relies on the superior technology of its defense systems as a competitive edge against overwhleming Soviet numerical advantages. There is strong evidence to suggest that the Soviet Union is rapidly reducing the U.S. technology lead through the transfer and assimilation of technology gained from the West. This paper examines the relevant issues of West to East technology transfer in order to provide awareness and appreciation of its importance to the security of the United States.

USAWC MILITARY STUDIES PROGRAM PAPER

INTERNATIONAL TECHNOLOGY TRANSFER
The Rope To Hang The West

AN INDIVIDUAL STUDY PROJECT
Intended for Publication
by

Lieutenant Colonel Neil W. Grotegut

Professor Michael I. Handel, PhD
Project Adviser

U.S. Army War College
Carlisle Barracks, Pennsylvania 17013
28 March 1989

"Technology is not science and it is not products. Technology is the application of science to the manufacture of products and services. It is the specific know-how required to define a product that fulfills a need, to design the product, and to manufacture it. The product is the end result of this technology, but it is not technology."

-- Fred J. Bucy --

ABSTRACT

AUTHOR: Neil W. Grotegut, LTC, AG

TITLE: International Technology Transfer, The Rope To Hang The West

FORMAT: Individual Study Project Intended for Publication

DATE: 28 March 1989 PAGES:37 CLASSIFICATION: Unclass

The United States relies on the superior technology of its defense systems as a competitive edge against overwhelming Soviet numerical advantages. There is strong evidence to suggest that the Soviet Union is rapidly reducing the U.S. technology lead through the transfer and assimilation of technology gained from the West. This paper examines the relevant issues of West to East technology transfer in order to provide awareness and appreciation of its importance to the security of the United States.

INTERNATIONAL TECHNOLOGY TRANSFER

The Rope to Hang The West

Introduction

During the past eight years there has been considerable public discussion and controversy about the efforts of the Soviet Union to acquire western -- especially American -- technology. It is an issue that has often placed the Congress, executive branches of government (most notably the Departments of State, Commerce and Defense), and other friendly nations at odds with each other over competing demands and parochial interests dealing with foreign policy, international trade, and national security.

This paper will consider some of the relevant issues of international technology transfer in order to provide awareness and appreciation of its importance to the security of the United States. We will explore the subject in terms of the significance the U.S. places on technology to maintain military advantage over the soviet threat, the importance of western technology to the Soviet military establishment, Soviet technology deficiencies and how they obtain western technology to offset these deficiencies, what

the U.S. does to preclude security oriented technology transfer, and the success the U.S. has had in limiting technology transfer to the Soviet Union and other eastern bloc nations.

The U.S. Security Edge: Quality vs. Quantity

It is no secret that the United States relies heavily on technology rather than numerical superiority in order to provide strategic balance. The U.S. lead in technology has traditionally provided a competitive edge against overwhelming Soviet numerical advantages. Its strong technological position balances sheer Soviet numerical advantages and thereby adds to deterrence. However, this once valid concept is becoming a cautious hope.

The U.S. has been rapidly loosing its worldwide edge in high technology goods and products of military significance. One need only review Soviet Military Power, the annual Defense Department assessment of Soviet capabilities, to gain an appreciation for not only the quantitative strides that Soviet and Warsaw Pact nations have made in relation to the United States and our NATO allies, but for the qualitative leaps that have occurred over the past two decades. A comparison of the "Relative US/USSR Technology Level in Deployed Military Systems" provided in the Seventh Edition of Soviet Military Power (April 1988) reveals the

significant progress the Soviet Union has made since these assessments were introduced in 1981 - a time when the U.S. held the advantage in virtually all key defense technologies (see Table 1).[1]

Relative US/USSR Technology Level in Deployed Military Systems*

Deployed System	US Superior	US/USSR Equal	USSR Superior
STRATEGIC			
ICBMs		■	
SSBNs	■		
SLBMs	■>		
Bombers	■		
SAMs			■
Ballistic Missile Defense			■
Antisatellite			■
Cruise Missiles		<■	
TACTICAL			
Land Forces			
SAMs (incl Naval)		■>	
Tanks		■>	
Artillery		■	
Infantry Combat Vehicles		■	
Antitank Guided Missiles		■>	
Attack Helicopters	■>		
Chemical Warfare			■
Biological Warfare			■
Air Forces			
Fighter Attack and Interceptor Aircraft	■>		
Air-to-Air Missiles	■>		
Air-to Surface Munitions	■>		
Airlift Aircraft	■>		
Naval Forces			
SSNs	■>		
Torpedoes		■	
Sea Based Aircraft	■		
Surface Combatants	■>		
Naval Cruise Missiles		■>	
Mines			■
C3I			
Communications		■	
Electronic Countermeasure/ ECCM	■>		
Early Warning	■		
Surveillance and Recon	■>		
Training Simulators	■		

Source: Soviet Military Power, 1988

Table 1

*These are comparisons of system technology levels only, and are not necessarily a measure of effectiveness. The comparisons are not dependent on scenario, tactics, quantity, training or other operational factors. Systems farther than one year from IOC are not considered.

The arrows denote that the relative technology level is changing significantly in the direction indicated.

Relative comparisons of deployed technology levels shown depict overall average standing; countries may be superior, equal or inferior in subsystems of a specific technology in a deployed military system.

According to Jay R. Sculley, the Army's Assistant Secretary for Research, Development and Acquisition, the Soviet Union has moved much more quickly that U.S. military planners had expected in developing the quality of their technology for major military systems. "They have increased their numerical advantage more than expected, and more alarming, have reduced and in some cases reversed the qualitative advantage we held. We have lost ground," he stated. "The uncertainties for the Soviets in conducting a conventional campaign in Europe have been reduced and so... has the deterrent posture of U.S. and NATO forces."[2]

There is mounting evidence that Soviet progress would not have been possible without the benefits they have gained through both legal and illegal technology transfers from the West - particularly the United States.

Western governments began to see clearly the Soviet technology dependence on the West in the early 1980s when a Soviet official defected in place, remained at a high position in Moscow, and began supplying volumes of top-secret information about Soviet technology collection efforts in the West. The agent, code-named "Farewell", revealed that the Soviet government had established a military industrial commission to assign tasks to Soviet intelligence services for acquiring needed technology.[3]

An April 1982 CIA report on the acquisition of western technology highlighted the key areas in which the Soviets and other East European nations had succeeded in obtaining a wealth of data that enhance their military capabilities. These acquisitions included such military sensitive areas as computer technology, microelectronics, lasers, electro-optical sensors, and radars (see Table 2).4

Reaping the harvest of Western technology

The following list, drawn from a 1982 report prepared by the Central Intelligence Agency, covers only a portion of what Soviet bloc countries have obtained through their aggressive pursuit of western technical expertise

Computers: complete systems designs, concepts, hardware, and software, including a wide variety of Western general-purpose computers and minicomputers with military application.

Microelectronics: complete industrial processes as well as semiconductor manufacturing equipment capable of meeting all Soviet military requirements if acquisitions were combined.

Manufacturing: automated and precision manufacturing equipment for electronics, materials, and both optical and laser weapons technology; information on manufacturing technology related to weapons, ammunition and aircraft parts, including turbine blades, computers and electronic components

Lasers: information on optical, pulse power source, and other laser-related components, including special optical mirrors and mirror technology suitable for future laser weapons

Guidance and navigation: marine and other navigation receivers, advanced inertial guidance components, including miniature and laser gyros, missile guidance subsystems, precision machinery used in producing ball bearings for missiles and other applications, and missile test-range instrumentation systems and documentation; and precision cinetheodolites for collecting data critical to post-flight ballistic missile analysis.

Electro-optical sensors: information on satellite technology, laser range finders, and underwater low-light-level television cameras and systems for remote operation.

Radar: information on air defense radars and antenna designs for missile systems.

Table 2

The 1986 Edition of Soviet Military Power reports that almost all of the 5000 ongoing Soviet research projects with military applications have benefited from technologies

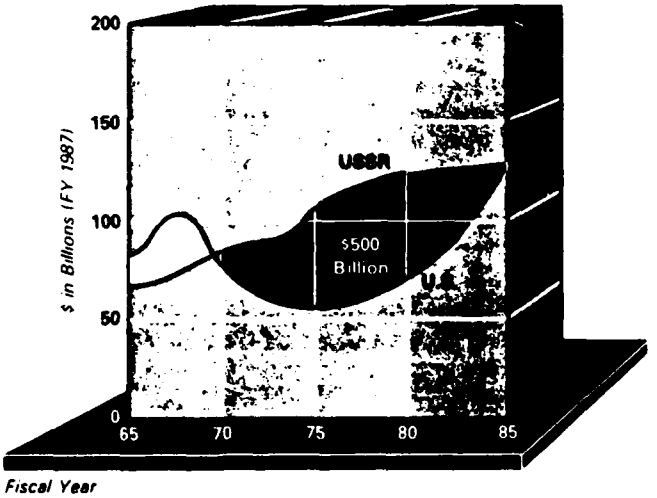
acquired from the West. Approximately 150 Soviet weapon systems, including intercontinental ballistic missiles, laser-beam weapons and advanced radar systems use technology perfected in America.[5]

This use of pirated technology provides several positive benefits for the Soviets. According to Richard Perle, a former Assistant Secretary of Defense (International Security Policy), the Soviets save billions of dollars and at least five years in their research and development cycle through technologies gained from the U.S. and other western sources. They tremendously reduce the risk of ineffective research and development and the cost of plant modernization. And, they are able to develop counter measures to our existing, and even anticipated defense systems, at a much faster rate than would otherwise be possible.[6] In short, pirated technology serves as a great way for the Soviets to reduce risk and save money under constrained resources. We do the research and development and they get much of the benefit.

The Soviets are indeed rapidly closing the technological gap by acquiring and adapting western technology and by pouring billions of rubles into military forces and defense systems. Table 3 illustrated the US/USSR defense investment for the two decades prior to FY 1985. From 1970 through 1985, the Soviet investment has been about

50% greater than the expenditures of the United States. While Soviet expenditures are based on rough approximations due to the nature of the Soviet political and economic systems, the comparison gives a useful sense of the scope of their defense programs. Because of this investment and the qualitative improvements the Soviets have garnered from western sources, the U.S. lead in advanced military technology has dropped from 10-12 years to 3-5 years.[7] The impact on U.S. national security is viewed as so significant that Secretaries of Defense Casper Weinburger and Frank Carlucci listed the prevention of The transfer of militarily critical technology to the Soviet bloc as one of the major national security objectives in their FY 1988/1989 "Annual Reports to Congress."[8]

A Comparison of U.S. Defense Investment Expenditures with the Estimated Dollar Cost of Soviet Investment[a]



[a]Includes RDT&E, Procurement and Military Construction, and Non-DoD-Funded Programs

Table 3

years. This compares to 2.6 percent of gross national product for research and development in the United States.[10]

With this level of investment in both personnel and financial resources, why would the Soviet Union devote such a concerted effort to the acquisition a western technology? The answer to this question lies in their history and doctrine, as well as in the realities of the significant economic and industrial problems the Soviets experience today.

Vladimjer Ilich Lenin bragged more than 60 years ago that "The capitalists...and their governments will shut their eyes to the kind of activities on our side...and will in this manner become deaf mutes but blind as well. They will open credits for us...They will supply us with materials and technology which we need for our future victorious attacks upon our suppliers. In other words, they will work hard in order to prepare for their own suicide."[11] Following Lenin's lead, the Soviet military realized long ago that by simply acquiring equipment from outside their borders and copying existing technology, they could speed up the procurement process and save the expense of costly research and development.

Using the expertise of foreigners is not new to the Soviets. In 1698, Peter the Great conducted a search

throughout Europe for the best technology of the day. With this effort, he largely transformed Russia from an unimportant medieval state to a political and military power.[12] After World War II, the Soviets obtained the services of German engineers and scientists which facilitated the wholesale transfer of the German rocket effort. American industry helped build a huge steel mill in the Soviet Union during Stalin"s first Five-Year Plan and the Soviets imported military aircraft from Britain, France, Holland, Italy and Sweden. When they built their first bomber after the war, it was a copy of the American B-29.[13] Later they bought the engine for the Mig 15 from Rolls Royce and used machine plants supplied by the West to manufacture weapons, tanks and armored vehicles.

In 1970, Leonid Brezhnev, under the guise of solidifying detente, proposed that western technology be used to build a mammoth truck plant along the Kama River in Russia. The United States contracted to build a high-tech assembly line and institute management systems that ultimately improved plant capacity by 60%. Unfortunately, the endeavor had the effect of an overt transfer of technology to enhance the Soviet military invasion of Afghanistan.[14]

In addition to historical traditions for relying on others for technology, the Soviets have had extreme

difficulty in turning their technological success into efficient production capabilities. Much of their inability for efficient production is attributed to the extensive Soviet bureaucracy, the inefficiency of their production capabilities, the lack of motivation among their workers, and to the closed nature of their political and economic systems. Their success in defense related industries has been attributed to large infusions of capital and manpower. But, as they move from pure science to applied science, the importance of sound technological capability and a strong economy increase.

The most important problem facing Soviet leadership today is the stagnation of economic growth. Due to an array of economic problems, they are no longer able to increase production through large capital and labor inputs. Two major factors contributing to economic stagnation are budget deficits (on par with those of the United States) and changing demographic trends which indicate the decline in the number of young, highly skilled workers. The Soviets have realized that they must become more productive if they are to reinvigorate their economy. Since they can no longer afford massive inputs of manpower and capital to keep pace with the West, an essential ingredient in their reform effort is to upgrade Soviet technology through the assimilation of technologies developed in the West. In this

way, the Soviets can save millions of rubles and up to five years development time.[15]

A recent statement made by Secretary Gorbachev to the Congress of East German Communists underscores the priority the Soviets place on improved capacity through technology. "We are faced with the inexorable historical task...to accelerate scientific, technological, economic and social progress," Gorbachev said. "Success in this undertaking will largely determine the future appeal of socialism and the strength of its international standing."[16]

Organizing for Piracy

To accelerate scientific, technological, and economic progress, the Soviets have established two major programs aimed at securing technology from the West. The first is through the Military Industrial Commission (VPK) of the Presidium of the Council of Ministers. The VPK seeks to improve the efficiency of Soviet military equipment and its industry by gathering actual technology, dual use hardware and software and technical documentation. The VPK identifies the required technologies and then charges either the KGB (the Committee for State Security), or the GRU (the Chief Intelligence Directorate), plus surrogate intelligence agencies within other eastern bloc nations to secure them.[17]

The second source for gathering western technology is through the actions of the Ministry of Foreign Trade and its overseas offices. Through these offices, Soviet agents administer a sophisticated trade division to import key technologies required to improve the efficiency of industry and production lines. The technologies sought are those primarily covered by export control laws (to be addressed later in this paper) which although not explicitly military, have military applications.[18]

Table 4 depicts the total Soviet organization that manages the external and internal research, manufacturing and acquisition effort. All ministries and departments/ agencies are supervised directly by the Council of Ministers. The dominant roles are played by the VPK and the Ministry of Foreign Trade (the requesters of western technology) and the KGB and GRU (the collectors of western technology).[19]

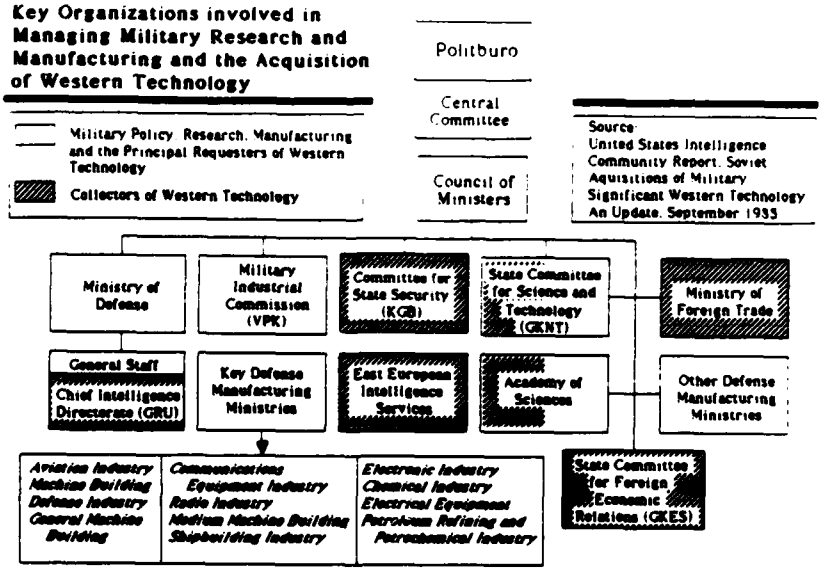


TABLE 4

The efforts of these agencies focus on acquiring technologies to offset Soviet deficiencies. American and western knowledge of needed Soviet technologies are derived from two major sources. First, Soviet deficiencies are based on assessments made by the Defense Technical Security Agency (DTSA), a DOD agency established in 1985 and charged with protecting sensitive western technologies. According to their report, "The Technology Security Program: A Report to the 99th Congress," Soviet deficiencies were assessed by the evaluation of Soviet and eastern bloc export requests since 1984. They include:

- Computer-aided design and computer aided manufacturing items for development of computer aided manufacturing centers.

- Hot isostatic presses for carbon-carbon and super alloy equipment enabling the manufacture of lightweight material critical to the production of strategic systems (e,g, greater accuracy and throw-weight for strategic missiles).

- Manufacturing equipment for large scale integrated circuits.

- Computer disk drives.

- Electro-optics and remote sensing.

- Automated production and control technology.

- Sensor technology principally for antisubmarine warfare. (Emphasis on seismic data collection and data processing equipment, advanced spectrum analyzers and analog to digital computers.)

- Computer technology (compact or personal computers and mass storage devices, particularly disk and tape drives and magnetic media).

- Micro-electronics technology.

- Telecommunications technology (analysis and measuring equipment with emphasis on research and development hardware).[20]

A second source for U.S. understanding of Soviet technological needs comes from a secret Soviet "shopping list" which details the high technology data and equipment the Russians want their spies to acquire in the West. The 27 chapter book (as thick as a city phone directory) is officially titled "Coordinated Requests for Technological Information", but is more commonly referred to as the "Red Book". Items in the book cover the same major categories as the DTSA assessment provided above. But, also included are numerous seemingly harmless items such as production plans for long life batteries and hydraulic systems. This would

likely indicate the need for improved engine start capabilities for military vehicles and tanks in cold weather.[21] Many of the Soviet acquisitions have no apparent military value at first glance; however, study of the Soviet economy can make it clear that any technology or piece of hardware that can benefit the military will be used to that end.

According to the West German Interior Ministry who announced the existence of this Kremlin shopping list, Soviet agents abroad are charged with obtaining at least four items from the list each year. And, "Those who acquire high-technology equipment would earn prestige."[22] It is through this shopping list, and the assessment of Soviet bloc export requests, that the U.S. Government and allied nations develop export control policies.

The Soviet reliance on others, and their sophisticated networks for acquiring western knowhow have produced some equally complex collection methods the intelligence organizations use to improve the Soviet technology and production base.

How The Soviets Do It

Articles in the popular press and on television frequently report on sensational espionage cases involving

the KGB. So when we think of methods of technology transfer, we tend to focus on covert measures that conjure up images of spies with bags of money enticing greedy employees and government workers to turn over national and corporate secrets. Where there is truth to that notion, the Soviets don't rely totally on covert measures to acquire information. In fact, many of their methods are completely open and legal.

Foreign agents frequently attend high-tech business fairs, trade and air shows, and participate in scientific exchanges to glean technical information. Even a visit to a toy store or "Radio Shack" can reward an agent with an amazingly accurate model kit of our most sophisticated aircraft or a state-of-the-art piece of microelectronics. Soviet scientists routinely read translated editions of the New york Times, Washington Post, Wall Street Journal, and study American scientific and professional publications.

U.S. laws make it easy to write the appropriate U.S. government agency and simply ask for the information under the Freedom of Information Act. You don't even have to be a U.S. citizen. According to Rear Admiral Edward A. Burkhalter, Director of the Intelligence Community Staff, "Just by asking the right questions, the Soviets are able to pull from the Federal government files reams of technical data not otherwise available to the public."[23] Robert M.

Gates, the Deputy Director of the Central Intelligence Agency, has stated that through these "open source channels, the Soviets obtain nearly half a million unclassified documents on technical subjects each year."[24]

While significant amounts of scientific and technical data are obtained through open and legal means, the vast majority of the Soviet effort is directed at covert and illegal methods. The Soviet Military Industrial Commission in a $1.4 billion program uses the Soviet Intelligence Services (primarily the KGB) to obtain military hardware, blueprints, product samples and test equipment that would be helpful in designing Soviet products to support their defense establishment.[25] Many items are simply purchased on the open market and stripped down to their smaller components and passed through diplomatic pouch or in a briefcase of handbag to elude export control and customs. In many cases, the secrets are learned from a piece of equipment without it ever leaving the U.S. borders.

Other methods include elaborate trade diversions involving western businessmen and trade brokers using dummy firms, deceptive equipment descriptions, false licenses and deceptive transshipments through intermediate countries. They plant and recruit spies, intercept phone calls and read computer emissions. Using "Red Book" lists, it is estimated that more than 2000 agents, smugglers and international

middlemen are actively working worldwide to fill requests from Moscow.[26] They come armed with cash and are willing to pay up to 500% of an items market price.[27]

Probably the most fruitful method has been through co-opting Americans who are willing to trade secrets for cash. Although not directly related to the transfer of western technology, the spy ring run by John Walker and Jerry Whitworth provided the Soviets with more than one million Navy coded messages concerning deployment patterns of our nuclear submarine missile fleets. In 1979-1980. James Harper sold Polish Intelligence information about the survivability of our Minuteman Missile against Soviet attack - a compromise with impact beyond calculation. Edward Howard, a case officer dismissed by the CIA, gave information to the Soviets that led to a series of arrests in Moscow, compromising our own intelligence gathering capabilities.[28]

One of the more sensational and devastating cases to impact on U.S. national security was the 1983/1984 Toshiba/Kongsberg sale of sensitive machine tooling equipment and computer software. This sale enabled the Soviets to mass produce super-quiet propeller blades for their submarines. This deliberate violation of export control laws for profit by premiere Japanese and Norwegian companies allowed the Russians to make submarine propellers

as quiet as those of American submarines. This removed the longtime U.S. advantage over the Soviets in submarine sonar tracking.[29] A Navy spokesman estimated that it could cost the U.S. taxpayer at least $30 billion to research, develop, and build a new generation of quieter submarines to gain the advantage sold away to the Russians by these Japanese and Norwegian firms.[30]

These examples represent merely the tip of the iceberg to the sensitive information and technology flow from the U.S. and other western countries. The impact on technology security has been so great that it is understandable why restricting the technology flow became a major priority of the Reagan Administration. President Reagan has said that stanching the flow of technology was one of his Administrations most important priorities.[31]

Restricting The Flow

The Reagan Administration wasted no time in embarking on a government wide effort to control the flow of significant western technology to the Soviet bloc. The initiatives have been both domestic and international and appear to have had a marked effect on reducing the transfer of sensitive security oriented technology to eastern bloc nations.

As early as October 1981, the U.S. Customs Service started "Operation Exodus" to try to stop the diversion of critical technology precluded from transfer outside the U.S. by export control laws. The operation netted 3667 seizures of sensitive equipment with a value of $221,581,822.00, and produced 243 indictments with 232 convictions.[32]

The cornerstone to the U.S. domestic effort has been to impose tighter controls over U.S. exports. The DOD Militarily Critical Technologies List (MCTL), first published in 1980, consists of more than 700 pages and contain over 300,000 controlled products. This list, combined with the Munitions Control List (Department of State) and the Commodity Control List (Department of Commerce) are the basic tools used by export licensing officials as a reference guide in detailing potential military applications of technologies that would be useful to Warsaw Pact countries. While the Department of Defense is not the lead agency in the administration of the Export Administration Act of 1979 or the Export Control Act of 1976 (the Departments of Commerce and State have respective leads), DOD has assumed an ever increasing role in the technology security arena.

In January of 1984, the Department of Defense improved its export licensing management for items destined to eastern bloc countries with the adoption of DOD Directive

2040.2, "International Transfers of Technology, Goods, Services and Munitions." The new directive clarified export license processing within DOD and set the stage for the establishment of the Defense Technology Security Administration (DTSA, a DOD field activity headed by Dr. Stephen D Bryen), which placed all DOD activities involved in the export license process in the same supervisory chain.[33]

In November of 1984, DOD implemented Public Law 98-94 (a 24 September 1983 amendment to Chapter 4, Title 10 U.S. Code) which, for the first time, authorized the Secretary of Defense to withhold certain technical data that previously could not be held back under the provision of the Freedom of Information Act. It specifically allowed the Defense Secretary to withhold technical information that may not be exported lawfully outside the U.S. without approval, authorization or license under export control laws.[34]

In January 1985, the President authorized DOD to review the licensing of high-technology products destined to 15 noncommunist countries settling a long running dispute over export control responsibility that had been raging between the Departments of Defense and Commerce. Prior DOD review had been limited to sensitive technology destined for Eastern bloc countries and China. Any disputes that should occur would be resolved by the National Security Council.[35]

It had been DOD's view that Commerce interests had been primarily economic and did not adequately consider technology security issues in the their dealings with noncommunist countries with lax export control laws. Many of these countries serve as intermediaries in the transfer process.

On the international level, the Administration has placed a concerted effort on strengthening the multilateral export control system known as COCOM or the Coordinating Committee. Based in Paris, COCOM is the organization through which NATO nations (except Iceland) and Japan attempt to speak with one voice as to the exportability of western goods and technology to Warsaw Pact countries, China and several other destinations. COCOM is intended to act on a unified allied level to halt the export of high-tech gear to unfriendly nations. But, violation of COCOM regulation and export control lists carry little or no penalty since COCOM is not impowered with any enforcement authority. Each member country agrees on export controls that each nation is supposed to enforce against its own nationals. Some take a much stronger stand than others.

Representative of the frustration that exists over COCOM export controls and its aggressiveness in pursuing violators of member countries are the remarks by Senator Jake Garn of Utah. He stated during the Toshiba/Kongsberg

hearings that "COCOM is about as toothless a tiger as ever existed, with their little old office over in Paris. They are more interested in profits that they are in the defense of their countries."[36]

Although the frustration has been high, there is evidence that there has been progress in improving COCOM activities. Secretary Weinbergers' FY 1988 Annual Report to Congress contained comments that COCOM "has become increasingly effective due to a variety of factors, including our substantial contribution for modernizing and automating the Paris facility and revamping the 'list' review process. COCOM's efforts are being taken with increased seriousness by all member countries. It has established a new mechanism through which the organization can benefit from timely significant strategic risks for the Western Alliance."[37]

The Administrations initiatives in reducing technology through tighter export controls and limits on free exchange of information have not been without controversy. There are many skeptics, both in the U.S. and abroad, who strongly believe that while we may be making a small dent in the technical data and materials that are making their way into Soviet military systems, we are stifling our own scientific progress and initiative. They argue that the government is

tampering with a free and open system that has been the cornerstone for U.S. technological success.

The Crackdown Controversy

Almost everyone agrees that the Soviets have received huge amounts of western technology in recent years. As we have seen, a great deal was transferred legally. And, as with the Kama River Truck Plant, transferred eagerly during the period of detente. However, the past eight years of effort to stem the technology flow appears to be making some headway -- but, at what cost?

There are legitimate warnings from industry and academia who argue that by restricting the free flow of information, and by clamping down on technology exports, the United States is doing as much damage to western research and development as it is to the Soviet bloc -- possibly more.

Government restrictions on publishing unclassified papers for use at open technical conferences, and limitations at U.S. scientific symposia requiring unclassified data to be labeled "NOFORN", as has been the case several times in recent years, not only keep technology from the Soviets, but from ourselves and our allies as well. These and other government restrictions on technology may

ultimately abort its future development. According to an April 1986 Military Logistics Forum article by Louis Lavoie, "Over reaction to the Soviet thirst for U.S. technology will dry the United State's intellectual wells and produce an effect every bit as profound as that which the United States hopes will occur in the Soviet Union."[38]

Business and industry also argue that export controls become a form of arms control imposed primarily upon ourselves. George Gilder, in an October 1985 Wall Street Journal article, commented that "We begin by embargoing advance weapon technologies sent directly to Moscow; we end up seizing Apple computers on the docks in San Diego and barring transfer of urinalysis equipment because it contains embedded microprocessors available by the millions around the globe."[39] Determined to deprive the Soviet Union of the ability to create very large scale integrated circuits, we delay shipments for months awaiting export license approvals, and thus, jeopardize the reputation of American companies as reliable suppliers on the world markets. By subjecting technologies to the endless bureaucracy of security clearances, citizenship papers, and nondisclosure agreements, we risk a setback to U.S. technology that may be more devastating in the long run than the work of thousands of KGB and GRU agents.[40]

Obtaining data and products has been the easy part for the Soviets. But, using this technology to develop and produce weapons systems and other military equipment has been more difficult. This, many believe, is where the Soviets have failed.

With todays technology, merely the possession of data or equipment does not mean that the technology can be duplicated. High technology products of today are based upon extremely sophisticated procedures, materials and knowledge applied in step by step processes. Reverse engineering of integrated circuits, for example, would require the tracking of hundreds of thousands of connections, an understanding of how they fit together (layering), and mastering the complex steps used in production. Omit one step in production and control, or one critical material, and the duplicate will not match or function like the original. For the Soviets, the costs in time, manpower and material are likely to render reverse engineering of modern technology a less effective method of development. For when you rely on the technology of others, you continually remain one or two generations behind the state-of-the-art. While Soviet scientists and engineers work to unlock the secrets, the pace of western technology will have widened the gap.

CONCLUSION

There is no doubt that technology superiority is a key element in the West's effort to maintain our strategy of deterrence and preserve the collective security of the free world. It is only through our effective use of technology that we can reasonably offset the quantitative advantage represented in the military capabilities of the Soviet Union and her eastern bloc allies.

Our national technology security policies and programs have been clearly established with this aim in mind. They have been, and should continue to be focused on protecting technologies that are incorporated into systems needed to perform our nation security missions. These policies, however, will be increasingly challenged by business and industry as the Soviet leadership continue their initiatives of internal restructuring and openness to the West. They have opened their arms to the West for credits and technology to improve their struggling economy. Although their ability to attract foreign investment has been slow (primarily due to bureaucratic restrictions designed to retain Soviet control), as they streamline policies and procedures, they will increasingly be viewed as a lucrative market for the West.

Both at home and abroad, the Soviet Union is increasingly perceived as a significantly reduced threat to national security. And, there is a great deal of support for that notion. They have withdrawn military forces from Afghanistan, allowed increased emigration from the Soviet Union, released political prisoners, conducted contested elections, unilaterally reduced forces in Eastern Europe, and relaxed freedom of expression for both the Soviet press and their citizens.

These are positive signs, but we must not lose sight of the significant offensive military capability that exists in the Soviet Union. While Secretary Gorbachev woos the West with glasnost and peristroyka, military modernization and tank production proceed unabated. One could argue that the success of U.S. technology security policies and programs of the past eight years have been a major factor in stimulating the recent Soviet initiatives toward internal restructuring and openness with the West. As covert and illegal methods for acquiring western technology have become more difficult, the Soviets may have simply modified their strategy for accomplishing their long standing doctrinal and ideological objectives.

Certainly, one of the most effective results of our technology security efforts has been to bring information about Soviet acquisition to the forefront in the minds of

industry, academia and the general public in the U.S. and abroad. But, we must also heed the warnings of industry and academia.

We need to strike a balance between overly restrictive technology security policies and our time honored traditions of commerce, open expression and academic freedom. We cannot afford to barricade the store any more than we can afford to have a clearance sale. Our technology effort should focus more on "technology processes" -- the know-how to move a concept through design, development and production -- and less on products and exhaustive lists that continue to grow and are rarely purged.

By drastically reducing the technologies and classified programs, we can effectively concentrate on existing and emerging technologies that have critical strategic significance. In this way, we can improve the efficiency of our export control processes, reduce restrictions on open exchange and academic programs, and lower the boom with the full force of law on those who seek to benefit from illegal transfer of critical security technologies. Certainly, some products will have to be monitored, but their numbers would be significantly reduced and within the resources available for effective control. We cannot afford, as Lenin predicted, to "sell the rope the Communists would use to hang the West." Nor can we fail to heed the warning of Sun

Tzu who in 350 BC said, "He who defends everything, defends nothing."41

Finally, we need to focus on opportunities to influence one other significant technology gap -- the ability to assimilate our own technology. To extend our lead, we must be more effective in using the technology we develop. We must cut through the bureaucracy and improve our development and acquisition processes. If we continue to allow as much as two decades between technology development and the fielding of a system (as with the Abrams Tank), we risk continued encroachment on our ability to deter, and if necessary, fight and win in our collective defense of the free world.

ENDNOTES

1. Department of Defense, Soviet Military Power: An Assessment of the Threat, 1988, Seventh Edition, April 1988, pp. 140-157.

2. Thomas Davis, "U.S. Withholding Its Technology, Soviets Complain," New York City Tribune, 20 June 1986, p. 2.

3. Arthur Van Cook, "Checks on Technology Transfer: The Defense Stakes are High," Defense Management Journal, First Quarter 1985, p. 9

4. Ibid.

5. Department of Defense, Soviet Military Power, 1986, Fifth Edition, March 1986, p. 108.

6. Van Cook, p. 9.

7. Warren Richey, "How Far Should US Go to Regulate Its Technology Exports," Christian Science Monitor, 16 May 1984, p. 16.

8. Casper W. Weinberger, Report of the Secretary of Defense to the Congress on the FY 1988 Budget, FY 1989 Authorization Request and FY 1988-1992 Defense Programs, 12 January, 1987, pp. 15 & 42; and Frank C Carlucci, Report of the Secretary of Defense to the Congress on the Amended FY 1988/FY 1989 Biennial Budget, 18 February 1988, p. 45.

9. Daniel Greenburg, "Technology the Soviet Way," US News and World Report, 20 October 1986, p. 21.

10. Ibid.

11. Edgar Ulsamer, "Moscow's Technology Parasites," Air Force, December 1984, p. 53

12. Louis Lavole, "The limits of Technology Transfer," Military Logistics Forum, April 1986, p. 35.

13. MSgt. Dan Allsup, "The Great High-tech Giveaway", Airman Magazine, October 1986, p. 17.

14. Henry R. Nau, Technology Transfer and U.S. Foreign Policy,p. 93.

15. "Technology, Soviet Industry," RUSI (Royal United Services Institute for Defense Studies), June 1987, p. 5.

16. Jackson Diehl, "East Europeans Scramble to Catch Up With West," Washington Post, 19 October 1986, p. 1.

17. "Spying Saves Millions in Soviet R&D," Flight International, 19 October 1985, p.10.

18. Ibid.

19. "Soviet Acquisitions of Militarily Significant Technology, An Update," United States Intelligence Community Report, September 1985, p. 3.

20. David Silverberg, "U.S. Export Control Efforts Bridle Soviet Acquisition of West's Military Technology," Defense News, 23 December 1986, p. 10.

21. "Soviets Seeking to Pirate West's Technology," Washington Times, 25 January 1985, p. 5.

22. Ibid.

23. Allsup, p. 16.

24. Kathrine Jones, "CIA Official Expects Soviets to Step Up Industrial Spying," Dallas Morning News, 12 February 1988 p. D1.

25. Ibid.

26. "Holding on to Military Secrets," New York Times, 18 October 1986, p. 26.

27. "Soviet Technology Acquisitions," Defense Science and Electronics, December 1986, p.59.

28. "Holding On To Military Secrets," The New York Times, 18 Oct 1986, p. 26.

29. Barbara Bradley, "US Ire Grows as Details of Toshiba Machine Affair Unfold," Christian Science Monitor, 11 September 1987, p. 13.

30. Jack C. Landau, Newhouse News Service, Washington, "Toshiba Should Compensate U.S.," Omaha World Herald, 15 September 1987, p11.

31. Joel Brinkley, "US, Despite Technology Curbs Sees No Big Cut in Flow to Soviets," New York Times, 1 January 1985, p.1.

32. "Sand replacing Jet Parts Apparently Headed for Iran", Colorado Springs Gazette-Telegraph, 7 December 1984, p. C11.

33. Casper Weinberger, Report of the Secretary of Defense to the Congress on the FY87, FY88 Authorization Request and FY 1987-1991 Defense Programs, 5 February 1986, p. 301.

34. Van Cook, P. 11.

35. Edwardo Lachica, "Pentagon Gets Rights to Review Licensing", Wall Street Journal, 14 January 1985, p. 38.

36. "Deadlock over Toshiba Ban Stalls on Export Controls," Congressional Quarterly, 12 March 1988, p. 623.

37. Weinberger, p.302.

38. Lavoie, p. 38.

39. George Gilder, "Technology Transfer: Secrecy Manias Only Backfire," Wall Street Journal, 1 October 1985, p. 32.

40. Ibid.

41. LTC Wayne A. Silkett, USA, and Major Eric J. Nickerson, USAF, "The Wrong Hands," U.S. Naval Institute Proceedings, February 1987, p. 36-37.